PNU University

Technical English for
Electrical Engineering Students

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«امروزه کتاب‌خوانی و علم‌آموزی، نه تنها یک وظیفه‌ی ملی، که یک واجب دینی است.»[1]

در عصر حاضر یکی از شاخصه‌های ارزیابی رشد، توسعه و پیشرفت فرهنگی هر کشوری میزان تولید کتاب، مطالعه و کتاب‌خوانی مردم آن مرز و بوم است. ایران اسلامی نیز از دیرباز تاکنون با داشتن تمدنی چندهزارساله و مراکز متعدد علمی، فرهنگی، کتابخانه‌های معتبر، علما و دانشمندان بزرگ با آثار ارزشمند تاریخی، سرآمد دولت‌ها و ملت‌های دیگر بوده و در عرصه‌ی فرهنگ و تمدن جهانی به‌سان خورشیدی تابناک همچنان می‌درخشد و با فرزندان نیک‌نهاد خویش هنرنمایی می‌کند. چه کسی است که در دنیا با دانشمندان فرزانه و نام‌آور ایرانی همچون ابوعلی سینا، ابوریحان بیرونی، فارابی، خوارزمی و ... همچنین شاعران برجسته‌ای نظیر فردوسی، سعدی، مولوی، حافظ و ... آشنا نباشد و در مقابل عظمت آنها سر تعظیم فرود نیاورد. تمامی این افتخارات ارزشمند، برگرفته از میزان عشق و علاقه فراوان ملت ما به فراگیری علم و دانش از طریق خواندن و مطالعه منابع و کتاب‌های گوناگون است. به شکرانه‌ی الهی، تاریخ و گذشته ما، همیشه درخشان و پربار است. ولی اکنون در این زمینه در چه جایگاهی قرار داریم؟ آمار و ارقام ارائه‌شده از سوی مجامع و سازمان‌های فرهنگی در مورد سرانه‌ی مطالعه‌ی هر ایرانی، برایمان چندان امیدوارکننده نمی‌باشد.

کتاب، دروازه‌ای به سوی گستره‌ی دانش و معرفت است و کتاب خوب، یکی از بهترین ابزارهای کمال بشری است. همه‌ی دستاوردهای بشر در سراسر عمر جهان، تا آنجا که قابل کتابت بوده است، در میان دست‌نوشته‌هایی است که انسان‌ها پدید آورده و می‌آورند. در این مجموعه‌ی بی‌نظیر، تعالیم الهی، درس‌های پیامبران به بشر، و همچنین علوم مختلفی است که سعادت بشر بدون آگاهی از آنها امکان‌پذیر نیست. کسی که با دنیای زیبا و زندگی‌بخش کتاب ارتباط ندارد بی‌شک از مهم‌ترین دستاورد انسانی و نیز از بیشترین معارف الهی و بشری محروم است. با این دیدگاه، به‌روشنی می‌توان ارزش و مفهوم رمزی عمیق در این حقیقت تاریخی را دریافت که اولین خطاب خداوند متعال به پیامبر گرامی اسلام(ص) این است که »بخوان!« و در اولین

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۱. پیام مقام معظم رهبری به مناسبت آغاز هفته کتاب ۷۲/۱۰/۴

سوره‌ای که بر آن فرستاده‌ی عظیم‌الشأن خداوند، فرود آمده، نام «قلم» به تجلیل یاد شده‌است: «إِقْرَأْ وَ رَبُّکَ الْاَکْرَمُ. اَلَّذی عَلَّمَ بِالْقَلَم» در اهمیت عنصر کتاب برای تکامل جامعه‌ی انسانی، همین بس که تمامی ادیان آسمانی و رجال بزرگ تاریخ بشری، از طریق کتاب جاودانه مانده‌اند.

دانشگاه پیام‌نور با گستره‌ی جغرافیایی ایران‌شمول خود با هدف آموزش برای همه، همه‌جا و همه‌وقت، به‌عنوان دانشگاهی کتاب‌محور در نظام آموزش عالی کشورمان، افتخار دارد جایگاه اندیشه‌سازی و خردورزی بخش عظیمی از جوانان جویای علم این مرز و بوم باشد. تلاش فراوانی در ایام طولانی فعالیت این دانشگاه انجام پذیرفته تا با بهره‌گیری از تجربه‌های گرانقدر استادان و صاحب‌نظران برجسته کشورمان، کتاب‌ها و منابع آموزشی درسی شاخص و خودآموز تولید شود. در آینده هم، این مهم با هدف ارتقای سطح علمی، روزآمدی و توجه بیشتر به نیازهای مخاطبان دانشگاه پیام‌نور با جدیت ادامه خواهد داشت. به‌طور قطع استفاده از نظرات استادان، صاحب‌نظران و دانشجویان محترم، ما را در انجام این وظیفه‌ی مهم و خطیر یاری‌رسان خواهد بود. پیشاپیش از تمامی عزیزانی که با نقد، تصحیح و پیشنهادهای خود ما را در انجام این وظیفه‌ی خطیر یاری می‌رسانند، سپاسگزاری می‌نماییم. لازم است از تمامی اندیشمندانی که تاکنون دانشگاه پیام‌نور را منزلگه اندیشه‌سازی خود دانسته و ما را در تولید کتاب و محتوای آموزشی درسی یاری نموده‌اند، صمیمانه قدردانی گردد. موفقیت و بهروزی تمامی دانشجویان و دانش‌پژوهان عزیز آرزوی همیشگی ما است.

دانشگاه پیام‌نور

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Preface

Technical English for the students of Electrical Engineering is aimed at undergraduate electrical engineering students whose, first language is not English. It promotes the development of the reading, writing and language structures in variety of ways throughout one semester in eight units.

Each unit in this book includes two sections described below:

Section one is named *Reading comprehension* and consists of three parts which is *Pre-reading, Reading* and *Post-reading stages.* In *Pre-reading stages,* Vocabulary preview is used of introducing new and unfamiliar words to students prior to reading or writing. Questions in many of the *Pre-reading stages* ask students to reflect on their prior knowledge of each chapter‘s topic. The aim of *Reading stage* is not to teach subject matter but to develop in the reader an understanding of how this subject matter is expressed through English. In this part, every fifth line of each reading passage is numbered for easy reference. *Post-reading* stage include in *Understanding Text, Reading skills and Building vocabulary.* Following each passage, in *Understanding Text*, some activities give students the chance to clarify their understanding of the text. These activities are True/False/Not Given questions and comprehension questions. In True/False/Not Given parts, students must decide whether each sentence agrees with the text or contradicts it, or whether there is not information in the passage to decide. Find answer key of multiple-choice questions at the

end of the book. At the beginning of each *Reading skills part,* students encounter a short explanation of the skill in focus and one or more exercises. *Building vocabulary* part develops technical vocabulary acquisition to provide students with the opportunity to review vocabulary items they may concerned with.

Section two is named *language study* and consists of two parts which is *Writing* and *Structure*. The principle purpose of Structure part is not to teach more grammar, but to show students how to use the grammar they may face in technical language. Some of structure part is considered for further reading. The main point of writing parts is to familiarize students with the fundamentals of writing, especially for academic purposes.

The authors have attempted to take advantage of the latest Electrical engineering text as well as the most up to date ones.

This book is now for your assessment and judgment. Kindly do send your feedback and queries on my email ID f_ghasemy@pnu.ac.ir

Unit 1

Section one: Reading comprehension

I. Pre-reading

A. Look at the definitions or synonyms of the new words as they appear in the passage

Word	Form	Definitions or Synonyms
alternating	adj	periodic
amplify	v	boost, broaden
aspect	n	side
assemble	v	join together, combine
bulky	adj	large, great
chassis	n	frame
component	n	part
demodulate	v	disassemble
denote	v	show
distribute	v	spread; give out
diverse	v	various
extensively	adv	widely
extremely	adv	highly
fundamental	adj	basic
innovative	adj	introducing new ideas
integration	n	combination, assimilation
peripheral	adj	marginal
preparation	n	provision
pursue	v	Follow
realm	n	domain
recover	v	regain
sophisticated	adj	developed to high degree
transmit	v	broadcast; send out

B. Guess the answer of following comprehension questions before reading the text.

1. Describe Electrical and Electronics Engineering.
2. What does electronic engineering deal with?
3. What is mechatronics?
4. Does a telecommunication engineer have training in information matters?

II. Reading

Electrical engineering

Engineering term is applied to a profession in which knowledge of the mathematical and natural sciences are obtained by study, experience, and practice. The term engineer properly *denotes* a person who has received professional training in pure and applied science.

Before the middle of the 18th century, large-scale **construction** work was usually placed in the hands of military engineers. Military engineering involved such works as the *preparation* of topographical maps, the location, design, and construction of roads and bridges. In the 18th century, however, the term civil engineering came into use to describe engineering work that was performed by civilians for nonmilitary purposes. With the increasing use of machinery in the 19th century, mechanical engineering was recognized as a separate branch of engineering. The technical advances of the 19th century greatly **broadened** the field of engineering and introduced a large number of engineering specialties, and the rapidly changing demands of the socioeconomic environment in the 20th century have **widened** the scope even further.

One of the largest and most **diverse** fields of engineering is **Electrical Engineering**; it is concerned with the development and design, application, and **manufacture** of systems and devices that use electric power and signals. Despite its diversity, electrical engineering can be divided into several main branches:

electric power, electronics, telecommunications, control, bioelectric, computers and mechatronics.

The field of **Electric power** is concerned with the design and operation of systems for generating, *transmitting*, and *distributing* electric power. Engineers in this field have brought about several **important** developments since the late 1970s. One of these is the ability to transmit power at *extremely* high voltages in both Direct Current (DC) and *Alternating* Current (AC) modes, reducing power losses proportionately.

Electronic engineering deals with the research, design, *integration*, and application of circuits and devices used in the transmission of signals and processing of information. Electronic engineers design circuits to perform **specific** tasks, such as *amplifying* electronic signals, adding binary numbers, and *demodulating* radio signals to *recover* the information they carry. Prior to the 1960s, circuits consisted of separate electronic devices—resistors, capacitors, inductors, and vacuum tubes—*assembled* on a *chassis* and connected by wires to form a *bulky* package. Since then, there has been a revolutionary trend toward integrating electronic devices on a single tiny chip of silicon or some other semi-conductive materials. Much of the research in electronics is directed toward creating even smaller chips, faster switching of *components*, and three-dimensional integrated circuits.

Engineers in the field of **Telecommunications** are concerned with all *aspects* of electrical communications, from *fundamental* questions such as "What is information?" to highly practical ones, such as design of telephone systems. A telecommunication engineer is responsible for designing and overseeing the installation of telecommunications equipment and facilities, such as complex electronic switching systems and fiber optics.

Control engineering is the engineering discipline that applies control theory to design systems with desired behaviors. It seeks to understand physical systems, using mathematical modeling, in terms of inputs, outputs and various components with **different** behaviors.

Control system also is a system of devices or set of devices, that manages commands, directs or regulates the behavior of other devices or systems to achieve desired results. In other words, the definition of a control system can be simplified as a system, which controls other systems. Control systems are used *extensively* in aircraft and ships, in military fire-control systems, in power transmission and distribution, in automated manufacturing, and in robotics.

Biomedical Engineering applies mathematics, science and engineering to medicine and health to advance fundamental understanding and create knowledge in the areas ranging from molecules to organ systems as well as to develop ***innovative*** approaches for the prevention, diagnosis, and treatment of disease, for patient rehabilitation, and for improving health.

Computer and information technology fields were virtually unknown just a few decades ago; computer engineering is now among the most rapidly growing fields. The electronics of computers involve engineers in design and manufacture of memory systems, of central processing units, and of *peripheral* devices. Foremost among the avenues now being *pursued* is the design of Very Large Scale Integration (VLSI) and new computer architectures. The field of computer science is closely related to computer engineering; however, the task of making computers more ~~"in~~telligent" (artificial intelligence), through creation of *sophisticated* programs or development of higher level machine languages or other means, is generally regarded as being in the *realm* of computer science and information technology.

Mechatronics is a design process that includes a combination of mechanical engineering, electrical engineering, control engineering and computer engineering. **Originally**, mechatronics just included the combination of **mecha**nics and elec**tronics**. Intelligent robots are prime examples of mechatronic system; it includes aspects of electronics, mechanics, and computing to do its day-to-day jobs.

III. Post-reading

Understanding the text

A. Read each statement below and determine if each one is true, false or not given in the reading passage.

TRUE (T): if the statement agrees with the information
FALSE (F): if the statement contradicts the information
NOT GIVEN (NG): if there is no information on this

1. ***T*** In the 19th century, mechanical engineering was introduced as a field of engineering.
2. … Engineers' salaries are higher than previously reported in past.
3. … Mechanical engineering deals with the design and preparation of topographical maps.
4. … Mechatronics Engineering is the integration of mechanics and electronics.
5. … German research could be a route to faster computer chips.
6. … Design of Very Large Scale Integration is a foremost issue in computer science at present.
7. … A telecommunication engineer supervises the installation of telecommunications equipment.
8. … Control systems cannot be employed in power transmission and distribution.

B. Find synonyms for the following words. Use bold words in the reading part.

1. initially *originally*
2. extended …..
3. distinct ……
4. production …..
5. building …..
6. new …..
7. main ……..
8. particular ….

C. Choose a, b, c, d which best completes each item.

1. Which of the following is/are characteristic/s of mechatronic products and systems?
   a) Functional interaction between mechanical, electronic and information technologies
   b) Special interaction of subsystems in one physical unit
   c) Intelligence related to the control functions of the mechatronics system
   d) All of the above
2. A group of components, which can complete certain tasks or achieve certain desired results in a desired manner, is called as_____
   a) output system b) sequence system
   c) control system d) all of the above
3. Electronic engineers are struggling to make ICs …… and ……
   a) smaller-faster b) bigger- faster
   c) noisy –faster d) bigger- slower
4. What does VLSI stand for?
   a) very loud scale integer b) very large scale integration
   c) very loss scale integer d) large-scale integration circuit
5. Artificial intelligence is mostly the branch of …….
   a) civil engineering b) computer science
   c) information technology d) b & c

Reading Skills

PREVIEWING

Previewing is glancing quickly through the reading passage without reading the whole things. Before you read something, it is important to look it over, or previewing it. When you preview a reading, you do three important things:

A) Identify the topic.
B) Think about what you already know about the topic.
C) Ask yourself questions as you go.

Doing these three things will help you understand a reading better.

D. Follow these instructions to identify the topic of the paragraph below.

1. Look at the textbox below. (Do not read the paragraph.) Based on the *title* only, what do you think the paragraph is about?

……
……

Nanotechnology

The ideas and concepts behind nanoscience and nanotechnology was showed by physicist Richard Feynman at an American Physical Society meeting at the California Institute of Technology in 1959, long before the term nanotechnology was used. Nanotechnology is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers. It‘s hard to imagine just how small nanotechnology is. One nanometer is a billionth of a meter, or 10-9 of a meter Nanoscience and nanotechnology are the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering. Today's scientists and engineers are finding a wide variety of ways to deliberately make materials at the nanoscale to take advantage of their enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity than their larger-scale counterparts.

2. *Keywords* are words that appear several times in a paragraph. In the paragraph above, the keywords are underlined. Based on the keywords only, what do you think the paragraph is about?
   a) What is nanotechnology
   b) How nanotechnology Works
   c) How to use nanotechnology

E. Before reading the paragraph answer to the following questions.

1. What do you already **know** about the topic?

The microscopes needed to see things at the nanoscale were invented recently. ……
……

2. What do you **want to know** about the topic?
What are the applications of nanotechnology?
……
……

F. Read the paragraph and look for the answers to the questions in exercise B.

Building Vocabulary

WORD FORMATION 1

An English word can be divided into three parts: a prefix, a stem, and a suffix. The basic part of any word is the **stem;** to it, you can add a **prefix** at the beginning and/or a **suffix** at the end to change the meaning.

PREFIX ⟹ STEM ⟸ SUFFIXE

Example:

Un ⟹ recognize ⟸ able

➢ Why should we learn English word formation?

Learning English word formation can provide us with three good advantages:

- **Increase your vocabulary.** Guess the meaning of the word by analyzing the known parts. Auto- means „self": autobiography, autograph (one's own writing), automobile, and automatic. This part of knowledge also helps us to understand words without dictionaries.
- **Deepen your understanding of a word** by analyzing each part of the word so that you can not only learn about the surface meaning but also the deeper connotation of the word.

-ard used in forming the personal nouns often has a contemptuous connotation in English. Drunkard, sluggard (someone who is very sluggish), we know they are contemptuous people who have developed very bad habits.

- **Enliven your language.** Create a lively style in your English writing. Bernard Shaw once wrote a famous sentence about the World War II, in it, he used several compounds which have been formed in the same way as the word outwit is formed. This kind of formation is very accurate in depicting the condition of the defeated Germany then. –Germany was outwitted, outprepared, outgeneralled, outfought, outflown, outgassed, outtanked, outbombed, and finally brought to her knees."

Many English words and word parts can be traced back to Latin and Greek. The following table lists some Latin and Greek roots from A to C.

Root word	Meanings	Examples
act	Do	active, interaction, react
alter	Other	Alternative
ana	throughout	analysis
ann	Year	anniversary
aqu	Water	aquarium
aud	Hear	audio
bible	Book	bibliography
bio	Life	biology
cata	Complete	catalog
ceed	Go	exceed
celer	Fast	accelerate
cent/i	Hundred	centimeter , century
chrom	Color	achromatic
circle	Round	Circuit
circum	Around	Circumflex
clud, clus	Close	conclusion
cumul	Mass	accumulator
cycl	Circle	Bicycle, bilingual

Table1-1. Latin and Greek roots from A to C.

G. Study table1 and try to find additional root words from A to C with examples. Use your dictionary if necessary.

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H. Find some words in the reading part, containing roots of table1.

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I. Use the following words to fill in the blanks.

bioengineering	*bibliography*	*Analyze*
around	*acoustic*	*Amplifying*
accumulation	*aqua-aerobics*	*Accumulator*

1. Can you measure the circumference of this circle? The root-word circum means……
2. ……. is an exercise down in the swimming pool.
3. ……... is a register in a computer used for holding the results of a computation.

4. ……..…..is a list of the sources you used to get information for your report.
5. The B.S. degree program in ……..……. provides students with fundamental knowledge of mathematics, science, and technology.
6. The materials will ……. to determine their characteristics.

Vocabulary Training Exercises

J. Use the words underlined in the following passages, either in their singular or plural forms, to fill the gaps in the blank sentences:

Easy exercise:

Electricity is the phenomenon associated with positively and negatively charged particles of matter at rest and in motion, individually or in great numbers. Since every atom contains both positively and negatively charged particles, electricity is connected with the physical properties and structure of matter and is an important factor in physics, chemistry and biology.

1. Lightning is a naturally occurring electrical _____.
2. Electrical conductivity is an important _____ of metals.
3. Atoms, which were once thought to be the smallest _____, are known to consist of even smaller ones.
4. _____, atoms have only a weak charge, but a very large number together can make a powerful charge.
5. Albert Einstein discovered the relationship between _____ and energy.

Challenging exercise:

Bioinstrumentation is the development of technologies for the measurement and manipulation of parameters within biological systems, focusing on the application of engineering tools for scientific discovery and for the diagnosis and treatment of disease. Examples include instrumentation for imaging, disease diagnosis, and therapeutics. Sensors in bioinstrumentation are used to understand physiological functions in healthy and diseased states, develop novel diagnostics and monitor patient health. Stimulation is applied to control disease or to restore function.

Bioinstrumentation used by physicians can be seen monitoring the condition of patients during surgery or during intensive care. Bioinstrumentation engineers develop and investigate many tools to detect, diagnose, and study biological conditions. For example, medical imaging systems apply energy, such as X rays, or sound waves, to the body to create detailed pictures of internal structures.

1. Patient _____ should minimally include blood-pressure and heart-rate _____.
2. _____ is the process of creating an abstract representation (a model) to represent important aspects of the real world.
3. _____ is a method of gaining control and handling of a parameter.
4. _____, travels at a certain speed and has the properties of frequency and wavelength.

Section Two: Language study

I. Writing

PREWRITING:

Prewriting is preparation that you can do before you actually write your paper, essay or summary. It includes:

1- **Choosing a topic**: exploring possible subject by reading, observing and thinking helps to find the right topic and naming it.

2- **Narrowing the topic**: Topic selection must be specific in the scope of an essay. For example, the topic "Internet" is a general one; in order to write on something more specific which will give a deeper and more detailed discussion of this topic, make it narrow and specific:

General subject: Internet

Narrowed topic: social networking site

Specific topic: How social networking site influence us

3- **Clustering**: This is a way to record author thoughts and observations for an essay after choosing a topic. In this section:

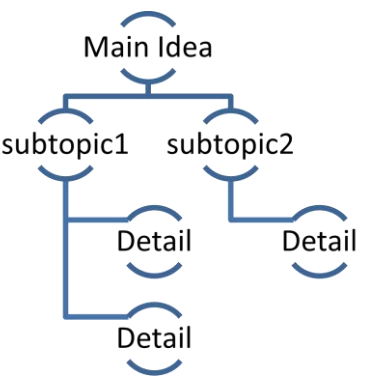
First draw a circle near the center of a blank piece of paper, and in that circle, write the **topic/main idea** of your essay.

Then in a ring around the main circle, write down the main parts or **subtopics** within the main topic.

Circle each of these, and then draw a line connecting them to the main circle in the middle.

Then think of **details** that relate to each of the subtopics, circle these, and draw lines connecting them to the relevant part/subtopic.

Repeat this process with each new circle until you run out of ideas. This is a great way of identifying the parts within your topic, which will provide content for the paper, and it also helps you discover how these parts relate to each other.



Exercise

A. Write a short writing to explain your reasons to study Electrical engineering:

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B. Write a short writing to explain the functions of clinical engineering:

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